NPS ARCHIVE
1969
BALOGH, H.

THE CAPITAL EXPENDITURE DECISION: WHERE TO LOCATE THE NEW FACILITY.

by

Howard Glenn Balogh

Gaylord
SHELF BINDER
Syracuse, N. Y.
Stockton, Calif.

DUDLEY KNOX LIBRARY
NAVAL POSTGRADUATE SCHOOL
MONTEREY, CA 93943-5101

THE CAPITAL EXPENDITURE DECISION
WHERE TO LOCATE THE NEW FACILITY

By

Howard Glenn Balogh

Bachelor of Business Administration

Youngstown University, 1952

A Thesis Submitted to the School of Government and
Business Administration of The George Washington
University in Partial Fulfillment of the
Requirements for the Degree of
Master of Business Administration

June, 1969

Thesis directed by

James R. Roman, Jr., M.B.A.

Assistant Professor of Business Administration

NPS ARCHIVE
1969
BALOGH, H.

Thesis B2033

LIBRARY
NAVAL POSTGRADUATE SCHOOL
MONTEREY, CALIF. 93940

TABLE OF CONTENTS

LIST OF TABLES iii

LIST OF ILLUSTRATIONS iv

Chapter

I. INTRODUCTION 1

The Research Question
Scope and Limitations
Methodology
Organization

II. CLASSICAL THEORIES OF INDUSTRIAL LOCATION . . 7

Von Thünen's Theory
Weber's Theory
Loesch's Theory
Hoover's Theory
Isard's Theory
Greenhut's Theory
Least Cost Theory of Location
Interdependence Theory of Location
Maximum Profit Theory of Location
General Industrial Location Theory

III. LOCATION FACTORS 23

General
Demand Factors
Transfer Costs
Material
Processing Costs
Trends in Industrial Location

IV. DECISION ANALYSES 60

General
Quantitative Analysis
Non-Quantitative Analysis

V. CONCLUSIONS 75

BIBLIOGRAPHY 79

LIST OF TABLES

Table		Page
1.	United States Population by Region and Division in 1966, and Projections to 1985 in Millions of Persons	30
2.	Value Added by Manufacturing in 1965, Retail Sales in 1963, Personal Income Per Capita in 1965.	32
3.	Ratio of Industrial Crude Materials Consumption to Gross National Product in the United States (in Per Cent of Gross National Product)	50
4.	Average Hourly Earnings by Region--1964 (in Dollars).	53
5.	Labor Force by Region 1960 and Projected to 1970 and 1980.	54

LIST OF ILLUSTRATIONS

Figure		Page
1.	Influences of Type and Location of Raw Materials on Plant Location.	14
2.	Major Market Regions.	29
3.	Strategic and Long-Range Planning	61

CHAPTER I

INTRODUCTION

> Locating a new plant is always somewhat of a traumatic experience for the business executive. Analysis, reason, calculation carry him to the threshold of a solution. But just beyond, a mountain of unanswered--and seemingly unanswerable--queries lie between him and his decision. From there on, his job becomes one of feel, intuition, "seat of the pants" guesswork, or a blind stab. Somehow, an answer is produced, but it rarely fails to leave a residue of uncertainty and uneasiness.[1]

This frank statement illustrates the concern for one of the most far reaching and important decisions for an industrial concern. While plant and equipment expenditures have more than doubled in the last ten years,[2] population has grown only 15 per cent.[3] Surely such an investment in the future will have a significant effect upon the welfare of our society as well as the business community.

Location decisions have had a major impact on the development of the United States. In our present state of

---

[1]Benjamin Chinitz and Raymond Vernon, "Changing Forces in Industrial Location," Harvard Business Review, Vol. 38, No. 1, January-February, 1960, p. 126.

[2]U. S. Congress, Economic Indicators, 91st. Cong., 1st. Sess., January, 1969, p. 9.

[3]U. S. Department of Commerce, Statistical Abstract of the United States, 1968, 89th Annual Edition, (Washington, D. C.: Government Printing Office, 1968), p. 4.

development well-marked areas exist where industry has concentrated, some areas are older than others, while several new areas seem to be developing. The phenomena of highly industrialized areas resulted from innumerable individual decisions over time. But as new techniques develop and new needs are generated, new industries appear; so, too, the rationale for location choice changes over time. The problem of finding the best location, however, remains.

The nature of the industry and the scale of operation are but two aspects that vary the problem of location choice. The problem of the choice of location can be viewed like any other capital investment problem. The difficulties are made apparent by this statement:

> Investment decisions are inherently more complicated and less subject to rule of thumb treatment than most of the decisions of a business firm relating to day-to-day operations. They relate to the "long run" rather than the "short run" and a mistake with respect to them is less easily rectified than in the case of more routine decisions. For the most part they are unique in some significant sense, in that no two investment decisions ever involve exactly the same circumstances. Business judgement of a high order is involved, because they are long run decisions which deal with an uncertain future environment about which knowledge is imperfect.[1]

In our fast changing and competitive world there is no room for irrationality in the judgement of decision makers. If a business is to survive and grow it must have an eye to the future. It must plan for progress as well as

---

[1]Frank E. Norton, "Administrative Organization in Capital Budgeting," Journal of Business, Vol. XXVIII, No. 3, July 1955, p. 291.

profit. Extended periods of dormancy risk deterioration and extinction.

Serious and rigorous treatment of location requirements is but one of the many problems that face industry. The purpose of this paper is to examine the location choice problem from the macro-level viewpoint.

The Research Questions

The basic research questions to be answered by this thesis may be stated as follows: What are the major location factors that should be considered in determining the location of a new branch plant at the regional level of decision? The subsidiary questions related to the main research question are as follows:

1. What are the current location theories?
2. What location theory provides the best logic for analysis at the regional level of decision?
3. What techniques of analysis are useful?
4. Is there a practical location model?

Scope and Limitations

The breadth of the subject matter is overwhelming. There is no attempt in this paper to develop new enlightenment in location or economic theories. The approach to be taken is to amalgamate the many theories and techniques prevalent in the subject matter area and to present in a logical fashion an approach to this complex problem. In

order to develop the paper in sufficient depth a number of limitations must be imposed. The first limitation confines the area of investigation to the macro-level scale of decision; that is, the regional decision rather than the local and specific site selection decision. The macro level usually is considered to be the global level; however, in the context of this thesis it will mean a region within the United States.[1]

Within the realm of location decisions there exist the relocation of an existing plant, the initial location of a plant for the newly formed company, and the expansion of an existing company. Since the objectives generally differ with each of these broad types of location decision, the second limitation restricts the paper to considerations involving the determination of a new branch plant location of an already existing going concern in the manufacturing industry.

The third limitation involves the framework within which the location problem will be examined. Among the many theories of location, divergent avenues of analysis may be undertaken to arrive at a basis for decision. The theories of location have yet to be perfected which fully explain the "real world"; therefore, use of the best concepts from the various theories must be made for analysis to proceed. The theories that will be used in this paper will

---

[1]Charles R. Hayes and Norman W. Schiel, "Why Do Manufacturers Locate in the Southern Piedmont?", Land Economics, Vol. XLIV, No. 1, February, 1968, p. 118.

be developed in Chapter II.

Methodology

This report is based entirely upon data collected from secondary sources. Chapter II is based primarily upon library research in the classic works on location theory. Chapters III, IV, and V incorporate data from textbooks and reports from professional trade journals, governmental sources, and research organizations. The secondary sources used incorporate data originally collected by interview, questionnaire, and case study methods.

Organization

Chapter II is designed to present the foremost theories of industrial location. Each of the theories usually postulate that industrial plants are located either to minimize cost or to maximize profits. They, like micro-economic theory, developed along two lines. The earliest approaches abstracted from demand and least cost analysis to explain plant location. The second approach has been purely an empirical approach. It is emphasized that Chapter II is not a complete presentation of all the important works in the theory of location and area development.

Chapter III presents the major location factors relevant for consideration at the macro-level. Each factor is analyzed as to its importance, interrelationship with

the other factors, and contribution to the location decision. The result is a workable classification of considerations for quantitative and non-quantitative evaluation.

Chapter IV is a two-part analysis of the important decision techniques available for determining the new location. The quantitative analysis portion is devoted to the various techniques used in developing, computing, and evaluating costs and benefits. The qualitative analysis portion relates to non-quantitative aspects of the location decision.

Chapter V is a summation of the findings and conclusions of this thesis.

Location of industry is among the most generally discussed economic issues of today. The store of the nation's resources and the well-being of its people are at stake when individual decisions are aggregated. Therefore, a good foundation for an understanding of the location decision properly begins with a study of the relevant theory.

CHAPTER II

CLASSICAL THEORIES OF INDUSTRIAL LOCATION

Theories of industrial location have evolved over the past 150 years. Common to each is historical observation. Since we have been in a period of rapid change for some time, technologically and otherwise, these theories have undergone continual modification to meet conditions in the real world. The value inherent in the study of theory is not only the basic concepts and hypotheses but also a perspective relevant to the many approaches to the complexities of the problem.

Von Thünen's Theory[1]

The first work in the field of location theory was published by Johann Von Thünen in 1826. Since his ideas were gained from his pastoral background, he limited his study to the location of agricultural industry. Von Thünen proposed an isolated city state called "the Town" completely surrounded by agricultural land of equal fertility. Since he assumed that all land was equally productive and that its supply exceeded its need, he concluded that the transporta-

---

[1] "Von Thünen's Isolated State," translated by Carla M. Wartenberg, Edited by Peter Hall, (New York: Pergamon Press Mc. 1966).

tion variable was the only cost variable of concern. Assuming further a constant transportation rate for a given weight and distance, Von Thünen reasoned that those products heavy in proportion to value would be cultivated nearest the city because of disproportionate transportation costs. He hypothesized that the value of a product at the point of production is equal to market value minus the transportation costs to market. This provided a framework with which he could examine production and distribution costs. His intensity theory, stated briefly, says that intensity of production will depend directly upon the market price of the farm product which is a function of transport cost. Thus concentric belts of differentiated crops result. Von Thünen's work now has little applicability, but it did provide an excellent foundation for later theorists.

Weber's Theory

Alfred Weber published his work, the Theory of Location of Industries, in 1909, nearly a century after Von Thünen's. Weber's theories relate only to manufacturing industries. In order to derive a general theory of location he grouped location factors into classifications of a general or special nature. Weber further classified location factors according to the influence they exercise:

"(1) into such as distribute the industries regionally and (2) into such as 'agglomerate' or 'deglomerate' industries within the regional distribution."[1] Weber considered the cost of transportation and the geographical differences in the cost of labor as influencing the regional distribution of industry, whereas he considered the economies and diseconomies resulting from the industrial concentration as influencing the agglomeration or concentration and the deglomeration or dispersion of industries within the regional distribution.

> If industry is influenced by the cost of transportation or by geographical differences in the cost of labor, industry is drawn to points geographically quite definite, though changing their position as industry develops. The factors which operate thus are regional factors of location. If industry, however, is brought together at certain points by price reductions due to agglomeration itself, whether it be the more economical use of machinery or merely the advantage of being at a place where auxillary trades are located; or if industry is driven from such congested places by the high rent, industry is agglomerated or spread within its geographical network according to certain general rules which are quite independent of geography. The factors which operate thus are agglomerative or deglomerative factors.[2]

Weber's theory starts by "supposing that all the isolated processes of industrial production will 'naturally'

---

[1] Alfred Weber's Theory of the Location of Industries translated by C. J. Friedrich, (Chicago: University of Chicago Press, 1929), P. 20.

[2] Ibid., p. 21.

at first be pulled to their most advantageous (optimal) point of transportation costs."[1] Therefore industrial orientation is created by transportation costs. Differences in costs of labor represent a force altering this basic orientation. Agglomeration or deglomeration factors act as a second altering force.[2] This is the essence of Weber's theory of the location of industry.

Therefore, Weber contended that transportation was the major variable affecting industrial location whereas labor costs and agglomeration/deglomeration forces act as secondary variables tending to alter and distort the effect of transportation costs on locational determination.

Weber made several simplifying assumptions to facilitate analysis. First, he assumed a given geographical ground plan of raw material deposits. Second, he assumed a given geographical sphere of consumption. Third, he assumed "fixed" labor locations of areas and "fixed" wages, yet the amount of labor available at the "fixed" wage is unlimited.[3]

The first problem he tried to solve was how transportation costs influence the distribution of industries. He concluded:

> It is clear that the cost of transportation depends upon the following factors, besides weight and distance: (1) The type of the transportation system and the extent of its use;

---

[1] Ibid., p. 35.

[2] Ibid., p. 35.

[3] Ibid., pp. 37-40.

> (2) The nature of the region and its kind of road; (3) The nature of the goods themselves; i.e., the qualities which, besides weight, determine the facility of transportation.[1]

He proposed that all rate differences in costs of transportation can be expressed in terms of weight and distance, since they are the predominant factors in the cost of transportation. Thus, he was able to simplify his theory by working with the ton-mile rate as the basic scale of transportation costs.[2]

Weber explained his laws of transport orientation:

> If weight and distance are the only two determining factors, evidently transportation costs will draw industrial production to those places where the fewest ton-miles originate during the entire process of production and distribution; for with production at these places the costs of transportation will be lowest.[3]

Weber observed that some raw materials contribute a larger proportion of their weights to the weight of the final product manufactured. He conceived two general kinds of material,ubiquitous and localized. Further he classified each as either "pure" or "weight-losing." Ubiquitous materials are materials available practically everywhere in certain regions. Localized materials are materials available only in specific geographically well-defind localities. "Pure" material imparts its total weight to the finished

---

[1]*Ibid.*, p. 42.

[2]*Ibid.*, p. 47.

[3]*Ibid.*, p. 48.

product. "Weight-losing" material imparts only part or none of its total weight to the finished product.[1]

Weber looked at the location problem as a struggle between locations of raw materials and consumption. From this he developed a "material index" which is the proportion of the weight of localized material to the weight of the product with ubiquitous materials being of importance only as they increase the weight of the product.

Another important measurement developed by Weber is the locational weight.

> The material index measures the total weight to be moved. This total weight to be moved in a locational figure per unit of product we shall from now on call the 'locational weight' of the respective industry.[2]

He concluded:

> First, generally speaking, industries having a high locational weight are attracted toward material; those having low locational weight are attracted toward consumption; for the former have a high, the latter a low, material index . . . . all industries whose material index is not greater than one and whose locational weight therefore is not greater than two lie at the place of consumption. Second . . . . Pure material can never bind production to their deposits . . . . Weight-losing material, on the other hand, may pull production to their deposits . . . . their weight must be equal to or greater than the weight of the product plus the weight of the rest of the localized material.[3]

Figure 1 represents Weber's view of the interrela-

---

[1]*Ibid.*, pp. 48-53.

[2]*Ibid.*, p. 60.

[3]*Ibid.*, p. 61.

tionship of transportation costs of materials, the source of supply, and the point of consumption relative to the location decision. Equal costs of transportation for equal weights of raw material and finished products hauled a given distance are assumed.

Referring to Figure 1, company V, using one pure material alone, gains no advantage by locating at either A (the point of supply) or B (the market point) and at no particular point inbetween. "The same weight is to be transported whether production is carried on at the place of consumption, at the mineral deposit (raw material), or somewhere inbetween."[1] Company W, using ubiquitous material only, gains by locating at the market point, since the material index is less than one and in effect the source of supply is the place of consumption. Company X, using one or several localized pure materials with ubiquities, gains by locating at the point of consumption, since advantage is gained by not transferring ubiquities. This position is further strengthened when the ubiquities are weight-losing. Company Y, using one weight-losing material, gains by locating at the point of material deposit. When ubiquities are added the location depends on the degree to which they strengthen the point of consumption. The choice of location is determined by the comparative size of the losses of weight and the weight of the ubiquities added. Company Z, using localized pure material, localized weight-

---

[1] Ibid., p. 62.

Figure 1

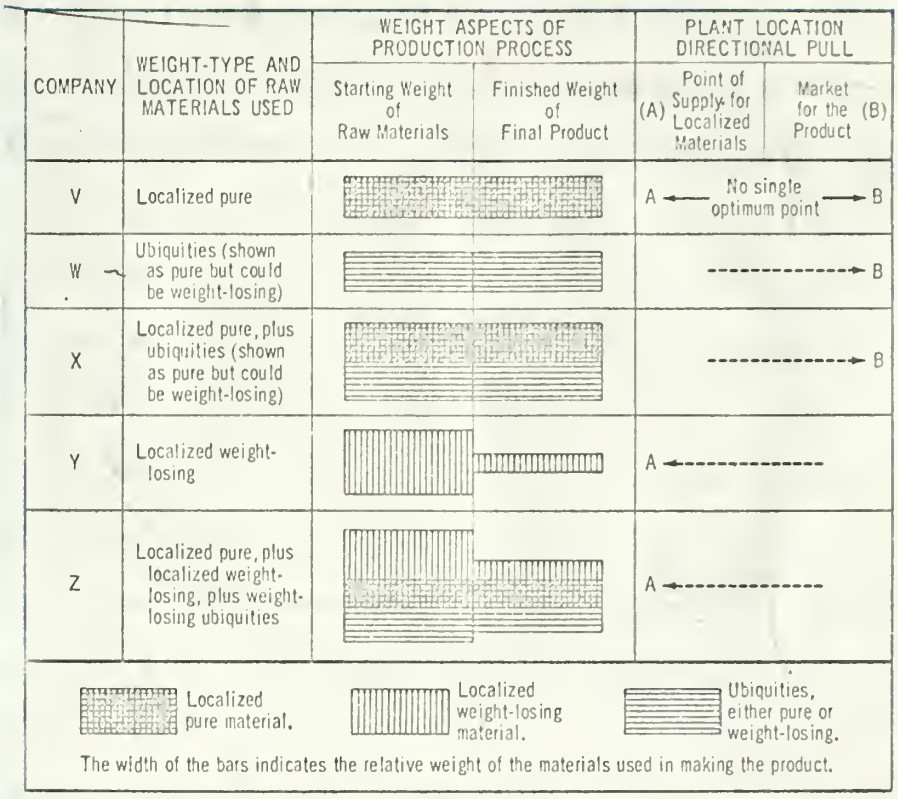

Figure 1: Influences of Type and Location of Raw Materials on Plant Location. This figure represents Weber's conclusions regarding the struggle for industry location between the place of consumption and source of raw material.[1]

---

[1]J. L. Heskett, Robert M. Ivie, Nicholas A. Glaskowsky, Jr., Business Logistics, (New York: The Ronald Press Co., 1964), p. 124.

losing material, and weight-losing ubiquities, will be drawn toward the material deposits. Remember, the pure material deposits have no attracting force. Once the losses in weight of the localized materials are balanced by the weight of ubiquities added, the material index is equal to one and the most advantageous location becomes the place of consumption. In summary, the forces mentioned are combined in such a way as to bring about an equilibrium position which results in least cost.[1]

In Weber's lifetime variations in labor costs constituted a major influence in the regional location of industry. Today, even with unionization, labor considerations still have a significant effect in altering and distorting the effects of transportation cost relative to the optimum location.

Weber believed that industry would concentrate around the point of minimum transportation costs. All forces other than transportation and labor are agglomerative or deglomerative forces. Agglomeration allows industry to reduce its production and distribution costs by centralizing activities primarily due to advantages of large-scale production through technical apparatus, localization, and urbanization economies. Deglomeration factors are countertendancies resulting from agglomeration primarily due to the inevitable increases in the land rent that accompanies

---

[1] Ibid., p. 61-67.

agglomeration. Weber perceived that effects of agglomerative forces could be determined only deductively.[1]

Weber's major contribution to location theory was to provide a very solid foundation upon which other theory could be developed.

Loesch's Theory[2]

August Loesch developed a theory heavily oriented to the market. Whereas Weber's theory assumed demand at a single consumption point, Loesch assumed demand was distributed among several consumption points. He postulated a geographical plane where all raw materials are evenly distributed, all industries and production methods accessible, and each businessman seeks a maximum profit. He illustrates that a single self-sufficient producer develops a market which is circular. As additional producers enter the market, his market takes on the shape of a hexagon as well as the market of each new producer. Each producer would have a special monopoly within each hexagon. Assuming f.o.b. mill pricing, the logical supplier for each consumer in a hexagon-shaped market would be the lowest priced firm; the market borders would be indifferent as to which adjacent supply sources from which to buy. Loesch's main contribu-

---

[1]Ibid., pp. 124-34.

[2]August Loesch, The Economics of Location (New Haven: Yale University Press, 1954).

tion to locational theory was to call importance to the market.

Hoover's Theory[1]

Edgar M. Hoover's major work "The Location of Economic Activity" was published in 1948. Hoover, like Loesch, considered demand at multiple consumption points, and, differentiated from Weber, investigated more fully the influence of freight rates and other realities of the transportation system. He introduced the concept of an idealized market-area whereas each producer has the same costs to produce. Yet he pointed out the unrealities of it as transfer costs are not only determined by distance but also by a tapering rate structure for longer distances, lower rates between major terminals, and variations in rates among modes of shipment. Hoover noted that industry tends to locate along organized routes of transportation and to concentrate at intermodal transfer points called "nodes." The transfer advantages of these points rest partly on large-volume traffic and frequent and flexible service. He illustrated that market areas are irregular in shape due to the influences of procurement, processing, and structure of transfer costs. Hoover placed this primary emphasis on least cost considerations in determining the optimum plant location.

---

[1]Edgar M. Hoover, Location of Economic Activity, (New York: McGraw-Hill Book Co., Inc., 1948).

Isard's Theory[1]

Walter Isard's chief concern in his major work Location and Space Economy was analysis of transport variables within a given geographical region.

> If there is any sense at all to location economics, it is because there are certain regularities in the variations of cost and prices over space. These regularities arise primarily because transport cost is some function of distance.[2]

He extended Weber's theory to analysis of market and supply areas. He concluded that market area analysis was the most precise approach possible.

Greenhut's Theory[3]

Melvin Greenhut published his major work Plant Location in Theory and Practice in 1956. He suggests that analysis of perfect competition in space results in a demand curve that cannot be perfectly elastic. Therefore, analysis in the framework of monopolistic competition is closer to reality than the perfect competition of classical economics. He concluded that location decisions then are based not only on minimum cost but also on demand elasticities. Stated another way, locations are determined not

---

[1]Walter Isard, Location and Space Economy, (New York: Wiley and Technology Press of M.I.T., 1956).

[2]Ibid., p. 89.

[3]Melvin L. Greenhut, Plant Location in Theory and in Practice, (Chapel Hill: The University of North Carolina Press, 1956).

only by cost minimization but also by profit maximization. However, his empirical studies suggested that the maximum profit theory was not all inclusive by excluding personal considerations; therefore, the theories were found lacking. His theory, then, is:

> . . . each firm will seek the site from which its sales to a given number of buyers can be served at the lowest total cost . . .
> . . . . . .
> . . . the pure personal factors are forces to be reckoned with not only from the stand point of particular site-selection but general equilibria in space, . . . Variations in psychic income may cause different ascriptions to cost data and encourage relocation and subsequent distortions of all existing relationships.[1]

Greenhut concluded that the optimum location is that point which causes the largest spread between revenue and total costs.

Least Cost Theory of Location

Von Thünen's and Weber's approach to the theory of location concerns least costs. To achieve the least cost location the sum of the transfer cost and production costs are minimized assuming a given demand at a given point unaffected by the location of the firm. The shortcomings of this theory results from its failure to recognize cost variability due to substitution among not only the cost factors at alternate locations but also demand factors at the alternate locations, market demand, and locational

---

[1]*Ibid.*, pp. 285-86.

interdependence of firms.[1]

Interdependence Theory of Location

This theory attempts to explain the location of firms based upon their efforts to control the largest market area. The shape of the industrial demand curve, the shape of the marginal cost curves, and the height of the freight rate influence the conjectural hypotheses of entrepreneurs regarding the location policies of his competitors. Greenhut concluded:

> (1) The tendency to disperse depends upon the height of the freight cost, the elasticity of the demand function, the characteristics (slopes) of the marginal costs, which factors, along with historical practice, determine the degree of competition in location. (2) Each seller seeks to control the largest market area, his actual location being determined by the type of interdependence existing between him and his rivals. (3) Each seller becomes a spatial monopolist, when sellers or buyers are separated geographically from rivals and when the selling industry uses the non-discriminatory f.o.b. price system. (4) Effective demand varies at alternative sites, because of freight costs and the location of rivals. (5) Three or more firms locate similarly as two, certeris paribus.[2]

The shortcomings of this theory is that it doesn't consider all the relevant factors of costs relying instead on special explanations based on spatial economics.

---

[1] Ibid., pp. 254-57.

[2] Ibid., p. 262.

Maximum Profit Theory of Location

Melvin Greenhut is the major proponent of this theory. Basically this theory expounds that the optimum location is where the largest spread occurs between revenues and total costs. The implications attendent to this theory is that the cost and demand factors can be treated effectively as variables. Under conditions of uncertainty a minimax force tends to draw firms closer together.[1]

General Industrial Location Theory

Simply stated this theory is a combination of the maximum profit theory of location and personal considerations. Personal considerations are included to the extent to which the minimax principle outweights the quest for maximum profits (The minimax exist not only in terms of uncertainty of business profits and the desire to restrain competition but also as regards the uncertainties of home satisfactions).[2]

The theories thus presented provide a broad framework upon which can be built the considerations applicable to a specific industry and business within a specific environment. As we have seen, the theories as they developed tended to explain the results of the empirical study concerning the multitude of individual decisions on

---

[1]Ibid., pp. 263-68.

[2]Ibid., pp. 281-85.

location choice. This provided a base of information, not strictly for historical explanation but for practical use in the here and now as well as for predictive work. The importance of this background will be self-evident in the next chapter. It will take up the macro-level viewpoint in determining a location. The specific considerations will be presented and analyzed along with their inter-relationships.

CHAPTER III

LOCATION FACTORS

General

Generally, the first step in applying location theory to the location problem is to look inward. This step is called plant analysis. In the process the critical cost factors are identified; production, distribution, and market analyses are conducted; capacity and product mix are determined; and location specifications or criteria are developed. Once this important step is completed, field analysis can commence.

Field analysis is the process wherein a geographical area is reduced to a few potential locations. The location specifications or criteria are evaluated from the regional, community, and site level viewpoints.[1]

Once the decision is made to expand by means of a branch plant, generally the next step is to decide in which region of the country to locate. It requires a study in size, nature, geographical configuration and future prospects of geographical areas. Further it involves not only determining alternative regions that meet the requirements

---

[1]Edward W. Smykay, Donald J. Bowersox, Frank H. Mossman, Physical Distribution Management, (New York: The Macmillan Co., 1961), p. 166.

of the location specifications but also the best one. This process requires consideration of the broad aspects of market demand, sources of supply of raw materials, transfer cost, processing cost, and trends pertinent to the specific industry and business concern.

Industry can be classified in many ways. The most common way is: (1) manufacturing; (2) mining; (3) agriculture; (4) service. To put the classification into perspective, manufacturing constitutes 26% of the National Income while mining is 5%, agriculture is 3%, and service is 66%.[1] Another way of classifying industry is by its orientation to: (1) markets; (2) materials; (3) labor; and (4) footloose. The forces that pull a plant location to a market are: (1) weight gains during production; (2) perishability of the finished product; and (3) differential freight rates between raw materials and finished products. The materials-oriented industries are influenced by: (1) weight loss during production; (2) perishability of the raw material; and (3) availability of the raw material at the source for the extractive process. The labor-oriented industries are influenced by: (1) greater needs for labor at cheap wages. The footloose industries are not greatly influenced by transfer costs. They tend to locate either at the market,

---

[1]U. S. Department of Commerce, Bureau of Census, Statistical Abstract of the United States, 1968, 89th Annual Edition, (Washington, D. C.: Government Printing Office, 1968), p. 312.

at the raw material source, or at some intermediate point. The combination of all forces influence the exact location selected in the case.[1] It is appropriate that analysis should begin with the most important consideration.

Demand Factor

At the outset it is important to understand that a major change in business philosophy is taking place in the switch to the marketing concept. Recent studies indicate that manufacturing costs account for only 41 per cent of the ultimate consumer price while the remaining 59 per cent is accounted for by non-manufacturing costs, of which the cost of physical distribution is likely to be the largest in most companies.[2] "Most managements today sincerely believe that their companies must make a complete shift to customer orientation and reverse the emphasis on production that accompanied World War II and the postwar shortage of goods."[3] The marketing concept means "that a business must receive its research, engineering, and production direction from the customer: he must be provided with the products or services he wants, when he wants them, where he wants them,

---

[1]Edward W. Smykay, Donald J. Bowersox, and Frank H. Mossman, Physical Distribution Management, (New York: The Macmillan Company, 1961), pp. 138-44.

[2]"The New Realities of Plant Investment," Dun's Review, Part II, March 1963, p. 131.

[3]Victor P. Buell, "The Major Challenge to Marketing," Emerging Trends in Marketing, (New York: National Industrial Conference Board, 1965), pp. 6, 7.

and at prices he is willing to pay."[1] In essence, the marketing concept holds that the survival of a firm depends on its ability to fill some need or want in the market place.[2] This dramatically shifted the trends in retailing and manufacturer's customer service in the 1960's.

Further, it is important to differentiate between consumer markets and industrial markets. The consumer market is a function of population and income patterns, whereas the industrial market is a function of industrial concentration (the agglomeration concept). The location of industrial markets is more highly concentrated than the consumer markets. Chauncy Harris states it this way:

> In the Manufacturing Belt of the North eastern United States, which occupies only a twelfth of the country, is concentrated half the entire national market, seventy per cent of the industrial labor force, and the sources of supply of most materials and parts directly used in manufacturing. It should be made clear at the outset that the existence of this historically evolved belt, with its markets, labor force, factories, mines, transportation, and other established facilities, is far more important than the distribution of any particular raw material (such as iron ore) or of fuel (such as coal or petroleum), or of any other single factor such as labor or markets.[3]

Yet there is a tendency on the part of industry to broaden its locational base to take advantage of the uneven disper-

---

[1]Ibid., p. 7.

[2]Harold Crookell, "The Gulf Between Economic Theory and Marketing Practice," Cost and Management, June 1968, p. 19.

[3]Chauncy D. Harris, "The Market as a Factor in the Localization of Industry in the United States," Annals of the Association of American Geographers, December 1954, p. 315.

sion of population and markets over the United States. Since distribution costs from these more remote areas to serve the national markets are generally higher than most parts of the Manufacturing Belt, industry has located branch industries in the South and West primarily to serve those regional markets.[1]

Industry stimulates and adds to its own markets by locating in its market areas thereby attracting population and increasing disposable income in a market region. Population begets industry, and industry begets population.

In analyzing the national market, Harris proposed:

> The United States may be divided into five grades of decreasing intensity of market as follows: (1) The Eastern Seaboard states extending from Massachusetts to Pennsylvania with high densities, five to fifteen times the national average; (2) the western half of the Manufacturing Belt from Ohio to Illinois with densities several times the national average; (3) most of the rest of the eastern half of the United States with densities about the national average; (4) the central and southern Great Plains with low densities; (5) the Mountain States and the Dakotas with low densities, only a twentieth to a fourth the national average.[2]

He subdivided the country into three great regional segments, each served by a major city which are in themselves the largest metropolitan markets in the United States: the

---

[1]Ibid., p. 319.

[2]Chauncy D. Harris, "The Market as a Factor in the Localization of Industry in the United States," Annals of the Association of American Geographers, December 1954, p. 321.

East served by New York City; the Central area served by Chicago; and the West served by Los Angeles.[1] See Figure 2.

The bulk of statistical information accumulated and published by the Census Bureau is based on four regions: the Northeast, the North Central, the South, and the West. Each region is further subdivided into smaller subregions. See Table 5 for a detailed breakdown. The point here is that the nation can be divided into as many regions as the individual firm chooses, and the composition of each region should best reflect the individual market characteristics of the firm and its product. However, data collection by governmental and private agencies normally uses the state and major city as the geographical boundary for compilation and dissemination purposes.

Market capacity is a type of measurement of a market area. The broad tools to measure market capacity from the regional viewpoint are statistical facts and business forecasts concerning population, sales, disposable income, per capita personal income, etc. For example, the population projections for the time frame 1966 to 1985 presented in Table 1 reveal that North Central and North East Regions of the United States will grow by approximately 28%, whereas the South will grow by 36% and the West, by 53%. Complement

---

[1]Ibid., pp. 331-35.

Figure 2

Figure 2--Major Market Regions. This figure represents the geographical market regions served by the three largest cities in the United States. The Eastern region is served by New York City. The central region is served by Chicago. The West region is served by Los Angeles. Reference: Annals of the Association of American Geographers, "The Market as a Factor in the Localization of Industry in the United States," by Chauncy D. Harris, December 1954, pp. 331-35.

TABLE 1

UNITED STATES POPULATION BY REGION & DIVISION IN 1966, & PROJECTIONS TO 1985, IN MILLIONS OF PERSONS

Region	Estimate	Projection			
	1966	1970	1975	1980	1985
United States	195.8	206.3	222.8	242.3	263.6
Northeast	47.9	50.0	53.2	57.1	61.3
New England	11.2	11.7	12.4	13.4	14.5
Middle Atlantic	36.7	38.3	40.8	43.7	46.8
North Central	54.3	56.2	59.7	64.1	69.3
East North Central	38.4	39.9	42.6	46.1	50.0
West North Central	15.8	16.2	17.0	18.0	19.3
South	60.8	64.4	69.9	76.1	82.8
South Atlantic	29.2	31.1	34.1	37.4	41.0
East South Central	12.9	13.4	14.3	15.3	16.4
West South Central	18.7	19.8	21.5	23.4	25.3
West	32.6	35.5	39.8	44.7	50.0
Mountain	7.8	8.4	9.3	10.4	11.6
Pacific	24.8	27.1	30.5	34.3	38.4

Includes armed forces personnel in the total resident population.

Assumes convergence of the 1955-1960 gross migration rates during projection and a very moderate decline in national fertility rate.

Source: Economic Almanac 1967-1968 Business Fact Book, National Industrial Conference Board, (New York: The Macmillan Company, 1967), p. 6.

this data with the fact that the West presently constitutes approximately 16.6% of the population (Table 1) with only 12.3% of the value added (Table 2), one can begin to project industrial development and its impact on a particular industry. Needless to say, more specific and detailed data can and should be developed within each firm concerning each product through market forecasts.

Because consumers are unevenly distributed over space, the location and possible relocation of competitors further complicate the location choice. Marketing strategies of product differentiation, market segmentation, and planned obsolesence along with price policies, channels of distribution, product promotion, etc., also affect the choice of location. When products of competing companies are similar the net effect seems to be toward decentralization in order to take advantage of market segmentation and promotion of high service standards. Those firms with differentiated products, however, tend to minimize uncertainty by concentrating location such that they compete actively in overlapping market areas.[1] Competitive advantage is also possible by increasing customer service. Raising volume provides an increased latitude in pricing, thereby providing a basis for stiffer competition with differentiated products as well as similar products.

---

[1]Edward W. Smykay, Donald J. Bowersox, Frank H. Mossman, Physical Distribution Management, (New York: The Macmillan Company, 1961), pp. 157-61.

TABLE 2

VALUE ADDED BY MANUFACTURING IN 1965
RETAIL SALES IN 1963
PERSONAL INCOME PER CAPITA IN 1965

Region	Value Added by Manufacture (in billions of dollars) 1965[a]	Total Retail Sales (in billions of dollars) 1963[a]	Personal Income per capita (in dollars) 1965[b]
United States	226.9	244.2	2,746
Northeast			
New England	15.9	15.0	2,995
Middle Atlantic	50.9	46.9	2,944
North Central			
East North Central	68.0	50.6	2,985
West North Central	13.9	21.0	2,624
South			
South Atlantic	25.1	32.3	2,364
East South Atlantic	11.5	12.3	1,920
West South Atlantic	13.1	20.9	2,228
West			
Mountain	3.6	10.1	2,501
Pacific	24.2	34.6	3,164

Sources: [a]Statistical Abstract of the United States, 1968, 89th Annual Edition, U. S. Department of Commerce, (Washington, D. C.: Government Printing Office, 1968), pp. 727, 767.

[b]Statistical Abstract of the United States, 1967, 88th Annual Edition, U. S. Department of Commerce, (Washington, D. C.: Government Printing Office, 1967), p. 327.

> . . . concentrations have at least two important effects upon long range competition within the industry. First, locating production plants within a relatively small geographical area tends to introduce warehouses as an important part of the physical distribution systems. As particular firms are able to intensely cultivate certain market segments, volumes may increase to the point where warehouses and latter branch plants can be economically justified.[1]

The maximum profit theory and interdependence theory as discussed in Chapter II lends a solid basis for viewing the market consideration as often the most important in location determination. Demand, as the entire credit side of profit and loss, is the major single variable in the derivation of profit. Thus, the tradeoff of increased costs on the debit side with increased sales on the credit side is generated. The competitive advantage rests with the firm which captures the largest share of the market and returns the highest yield on investment.

Transfer Costs

> Within a nation, the development of a region is directly related to its ease of access to resources and to outside markets, or more generally to its physical position relative to other regions. Transportation systems are designed to overcome the frictions (distances, natural obstacles, etc.) imposed by geography. As such, they shape the distribution of activities and influence the share by which each region contributes to the national product.[2]

---

[1] Ibid., p. 158.

[2] Charles River Associates Incorporated, The Role of Transportation in Regional Economic Development, (Prepared for U. S. Department of Commerce, Cambridge, Mass., n.d.), p. 1.

Transfer cost is but an integral part of the production and distributive process. A commodity is useless until it arrives at the point of consumption. Transfer costs, thus, measure the cost to assemble materials and distribute products. Transfer costs consist of direct or transport costs and indirect costs. Basic to consideration of transportation cost is the realization that two kinds of direct costs exist: (1) Line Haul Costs and (2) Terminal Costs. Line haul costs involve the movement of a commodity over a distance. Characteristic to line haul is a tapering effect with increasing distance. Terminal costs involve the loading at origin, in-transit storage, and unloading at destination of the commodity. Further, there are less recognized indirect costs:

> . . . the costs of movement are not fully expressed by freight charges. Other costs that add materially to the total sum are also incurred, eg. cost of insurance on goods and materials en route, interest charges on their capital cost, losses incurred by deterioration of or damage to the product in transit, clerical costs and so on . . .
>
> . . . . . .
>
> It behoves the producer to examine the type and quality of transport services available, for the speed, regularity, and dependability of the services will be reflected in the "indirect" costs of movement.[1]

Transportation costs depend not only upon distances but also the product to be transported. The bulk, weight,

---

[1]R. C. Estall and R. Ogilvie Buchanan, Industrial Activity and Economic Geography, (London: Hutchinson University Library, 1961), p. 36.

transferability, and value are characteristics of the product which have a direct bearing on rate making. While distances do not change, the products and technology do. The miniaturization of electronics equipments serves as a good example. The value, bulk, and weight of the product changed drastically and thus placed higher demands on premium transportation to provide speedy customer service and to allow reduced inventories.

The relationship between short and long haul costs have a significant effect upon location. Relative reduction in short haul costs tends to encourage industrial decentralization and location closer to the market, whereas relative reduction in long haul costs tend to encourage industrial centralization. The development of the highway system and truck transportation has modified the transport structure in favor of the short haul. Thus the local or small scale producer is able to compete with the distant producer who uses economies of scale simply by trading off lower transportation costs for higher costs of production.[1]

Fabrication in transit privileges permits the material to be processed at a point in the transportation route yet retain the long haul rate. This privilege is extended even when a different product as a result of the processing is transported in the second part of the haul.

---

[1]Benjamin Chinitz and Raymond Vernon, "Changing Forces in Industrial Location," Harvard Business Review, Vol. 38, No. 1, January-February, 1960, pp. 130-32.

As a result manufacturers are less tied to the source of the raw material or the market for his product.

The basic rate structure contains variances in class rates, exception rates, and commodity rates between regions and within regions. Couple this with: other variations in rates, such as, less than carload, carload, less than truck load, truck load, and blanket rates; and different modes of transportation; and combinations of modes it becomes obvious that comparisons of regions for regional analysis becomes quite complex and time-consuming. The present rate structure is a legacy of history and much too complex a subject to delve into in this thesis, but it seems clear that rate structures and price levels influenced the pattern of regional development.

Our transportation system is complex. The nation is crisscrossed with railways, highways, waterways, and airways. Each mode of transportation is in competition with each of the others. Generally speaking, among the interior land modes of transportation relative advantage is given to truck transport for short haul and to rail transport for long haul. There is keen competition for the intermediate haul between truck and rail with innovations in both industries. Perhaps the best known innovation in combining modes into a coordinated system is the "piggyback" or trailer-on-flatcar. Other coordinated

systems are: truck-water, truck-air, rail-water, ship-barge, and pipeline combinations with truck, water, or rail modes.[1]

Transfer costs have traditionally been the focus around which location decisions have been made. The relative ease in quantification in comparison to other location factors may permit a convenient starting point, but it must be remembered that transfer cost is but one of the many factors to consider in determining a suitable location. The relative importance of transfer cost varies from one industry to another. For those concerns where transfer costs constitute a major cost, a comparative advantage in transfer costs, when other costs and services are equal, tends to draw location to the point of minimum cost. Clearly then transportation advantage or disadvantage can reinforce, diminish, or cancel out the advantages of the other factors. To be fully acceptable, however, the least cost point for a unit of sales must offer more. "The location must also help the company outsell its rivals in key markets and place a wider area under its control."[2]

---

[1]J. L. Haskett, Robert M. Ivie, and Nicholas A. Glaskowsky, Business Logistics, (New York: The Ronald Press Company, 1964), pp. 58-66.

[2]Leonard C. Yaseen, Plant Location, (New York: American Research Council, 1960), p. 15.

From the viewpoint of where to locate on the regional level, it is necessary to consider the following aspects of transfer costs:

(1) Which of the many types of transportation services are to be used by the branch plant and which of the many regions provide the services needed.

(2) The relative costs of services among the regions.

(3) The relationship of services and cost to production and distribution.

(4) The effects of future changes in costs of services.

(5) The effects of future changes in transport mode characteristics.

In addition, the flow of incoming and outgoing movements should be understood so that in the planning of the plant location advantage can be taken of the natural flow rather than needless transfers among modes and routes.

Transportation facilities and services are not evenly dispersed over space. Some regions are better endowed with certain modes whereas other regions are less endowed due to natural, historical, or political causes. Early in our nation's history transportation was a leading sector of the economy. Some economists contend it is now a lagging sector of the economy. Whether transportation causes or results from industrial location, there is a chain reaction between transportation and development.[1]

---

[1]Charles River Associates Incorporated, The Role of Transportation in Regional Economic Development, (Prepared for U. S. Department of Commerce, Cambridge, Mass., n.d.), pp. 53-65.

In the final analysis the existence of an adequate transportation network is essential to the establishment of the branch plant. Improvements in the network and a more favorable rate structure may result over time with the shift of businesses into the region and negotiations with the transportation agencies.

The specific needs of the branch plant in the way of transportation systems, facilities, and services are thus compared to the endowments of each of the regions considered. Trade-offs are utilized where a specific need is non-existent and/or not feasible for installation through negotiations with transportation agencies. However, location in regions richly endowed with highways, railroads, airports, and waterways is an indication but not an assurance that adequate services and facilities are available at the otherwise desirable community or site location.

The costs of services and facilities required and available must be compared by regions. Due to variances inherent in the rate structure, variations in rates amongst regions, and variations due to modes to be utilized, the construction and evaluation of detailed cost comparisons will be necessary to show the least cost modes and regions.

However, costs and availability of a suitable transportation mode may not always be the most important trans-

portation considerations. Speed, particularly, is becoming increasingly important. When high value products, critical components, and perishable products are involved, speed becomes relatively more important than cost. Further, widened markets often counterbalance the increased costs of premium transportation. Thus, accessibility to transportation modes may be critical to the producer of the above mentioned type products.

Changes in costs and mode characteristics are but two situations which can change the competitive position of a corporation. A new branch plant is an investment in the future and affected by the environment of the future. Since it may take years to design and build a new plant and put it into operation, it is necessary to project into the future. For example, when freight rates increase at a faster rate than production costs, shrinkage in the profitable marketing zone may result. Further, general freight rate increases widen the differential between short haul cost of the small scale local competitor and long haul costs of the larger plant in a distant city, thereby further reducing the profitable marketing area of the large scale producer. This has been reinforced by highway development programs and the development of truck transportation. A trend of increasing costs of transportation above the general cost trends and a decline in short haul

costs relative to long haul costs provide two incentives toward regional duplication of production facilities as a strategy to counter the local small scale producer.

Since transportation costs are interrelated to production and marketing processes, the principle of marginal cost can be used to show that increased production volume depends upon a balancing of the economies of scale against increased cost of transporting to a larger market. When economies of scale do not compensate for increased transportation costs incident to supplying distant markets the impetus to locate branch plants often result. When attempting to expand a firm's share of the national market, location of competitors and market areas are analyzed in an attempt to locate branch plants in locations that will exclude competitors from the market region by freight and/or other cost advantage of the new branch plant location.

Rate-making policy is largely established according to the "value of commodity" principle. If the principle were to change to average or marginal cost pricing, rates particularly on finished goods would be reduced and on bulk commodities would be increased. Therefore, comparative advantage may be shifted within some industries primarily because of the immobility of their plant facilities. The Charles River Associates reported to the Department of Commerce:

> The trend in regulation is definitely toward a cost based pricing principle. This trend, if it fully materializes, almost surely would lower the price of transporting manufactures by rail, and might increase the price of moving bulk commodities. Inscfar as transport costs have any locational leverage, this would tend to promote industrial centralization, and possibly at sites closer to raw material sources.[1]

Technological changes in transportation mode characteristics are somewhat offsetting due to the competitive nature of the transportation industry. Technological improvements generally result in reduced transportation costs to the customer. Containerization, one of the more important developments, will provide a more uniform and extensive coordinated transportation system. The impact of expected future lowered costs and increasing ubiquity of transportation systems, however, seems to point to a decline in the importance of transportation in the long run.

The comparative advantage or disadvantage between regions may be somewhat transitory if too much reliance is placed on present transportation advantage. Improvement in transportation networks and links and lower transportation costs may shift the comparative advantage between regions. Therefore, "a transportation advantage is not a perfect substitute for a natural production cost advantage in the sense that the corresponding transportation cost

---

[1]*Ibid.*, p. 120.

differentials are certainly less permanent than interregional production cost differentials which are based say, on resource endowments."[1]

Three kinds of differentials result from the development of transportation facilities between regions. First, better intraregional transportation facilities and networks result in a more efficient and economical distribution system. Thereby, regional markets become more fully integrated. The customer is attracted more readily to the regional industry. Better interregional transportation links can reinforce the comparative advantage of a region by opening up a greater market area to the industry. Where the region under consideration lacks a comparative advantage in procurement, production, and distribution, a transportation advantage may provide the offset. Second, technological innovation can improve the comparative advantage of a region through reduced costs for long and intermediate hauls and improved services. Notably the development of the super-cargo aircraft will improve the comparative advantage of those locations at the airport hub of transport nodes. The high initial investment requirements, large capacity, and high total operating costs will limit the super-cargo aircraft to routes originating and terminating at the airport hub with a high demand for air freight.

---

[1]Ibid., p. 29.

The differences between ton-mile costs of air versus other modes of transport may be compensated for to a degree by qualitative advantages of speedy service, low loss rates, low packaging costs, low loss due to pilferage, and high probability of delivery on a given date. Third, transportation rates where they differ as to the same commodity over distance or direction affect location. Revision of the transportation rates could upset the balance of comparative advantage upon which previous location decisions were based. Therefore, not only is the relationship of one region versus another affected but also the relationship between the long haul versus short haul.[1]

Material

> The processor of raw material is concerned with the source of his raw material and of his buying market; the finished good manufacturer is concerned with his raw material source (or semi-finished good) and the consumer market. The governing elements in the respective locations are (1) the transportability of various goods, (2) the location of raw material producing industries, and (3) the situs of the buying markets.[2]

The term "raw material" can be defined to mean not only the basic industrial raw material found in a natural

---

[1]Charles River Associates Incorporated, The Role of Transportation in Regional Economic Development, (Prepared for U. S. Department of Commerce, Cambridge, Mass., n.d.), pp. 69-71.

[2]Melvin L. Greenhut, Plant Location in Theory and Practice, (Chapel Hill: The University of North Carolina Press, 1956), p. 108.

state but also to include commodities or products which have been partially processed or are completed components. The types of natural raw material can be generally categorized into: mineral fuels, non-fuel minerals, forest products, raw materials from the sea and atmosphere. The major characteristics of raw materials and their impact on location theory were brought out adequately in Chapter II. However, the quality of the raw material did not receive treatment. Suffice it to say that all raw materials are not of equal quality. Consequently, the proportions of the various raw materials required in the manufacturing process are not rigid and fixed. Hoover points out:

> Actually it is possible to vary most industrial processes so as to use relatively less of a given material where it is expensive and more where it is cheap. Thus the proportions of material required are not, in fact, constant but vary according to the relative delivered prices of the respective materials at different production locations.[1]

Thus, the significance is that various sources should be analyzed based upon the variety of possible proportions to determine the best combination.

Sources of raw materials may be domestic or foreign. The feasibility of foreign sources, new sources perhaps closer to the regions under consideration, and undeveloped sources of lesser quality grade materials should be con-

---

[1]Edgar M. Hoover, The Location of Economic Activity, (New York: McGraw-Hill Book Co., Inc., 1948), p. 44.

sidered in the intelligent search for raw materials. The quantity endowment and accessibility of each source is a vital consideration. Sufficient endowment for the long-range needs of the new location become a prerequisite of doing business. However, for some industries, "The production process is changing. Products are becoming more highly fabricated, raw materials are less important, and production is becoming more divisible."[1]

> An examination of the raw material supply patterns of industry indicates that in this factor, too, there is a declining impact of geography. In the first place, the raw materials of more and more industries are now drawn from manufactured sources rather than natural ones. The former are more widely distributed than the latter, tending to locate in the various industrial areas of the country. Second, the reduction of tariff and the gradual freeing of foreign trade have opened up foreign sources that can provide materials at all major ports at comparable costs. . . .
>
> . . . . . .
>
> Finally, technology has permitted the development of resources in areas where those resources were previously uneconomic.[2]

Advances in technology create a dynamic situation relative to raw materials as well as the other factors affecting location. The development of new materials with

---

[1]Charles River Associates Incorporated, The Role of Transportation in Regional Economic Development, (Prepared for U. S. Department of Commerce, Cambridge, Mass., n.d.), p. ii.

[2]Management and Economics Research Incorporated, Industrial Location as a Factor in Regional Economic Development, Prepared for U. S. Department of Commerce, (Washington, D. C.: Government Printing Office, n.d.), p. 19.

potential growth may lead to considerable changes in materials uses within the next ten to twenty years. Further, changing trends have an effect upon the raw material and its relationship with the future. The Canadian-American Committee reported in 1960 that:

> Among the developments that may cause deviations from past patterns are the following:
>
> A. General economic developments.
> 1. Suburbanization and urban development.
> 2. The extension of superhighways and the shift of some transportation back to railroads via the "piggy-back" method.
>
> B. Changes in methods and end products.
> 1. The further adoption of automation.
> 2. The uses of atomic energy in the generation of electric power.
> 3. The possible direct conversion of heat to electric power through thermo-electric devices or ionized gases.
> 4. Improvements in the storage of electric energy and the revived use of electrically-driven vehicles.
> 5. The further adoption of gas turbines, jet engines, and small diesel engines on an accelerated scale.
> 6. The growing use of small and compact automobiles.
> 7. Increased use of light-weight materials in construction.
> 8. Prefabrication and the use of modular units in construction.
> 9. Revolutionary changes in communication, such as facsimile transmission of messages and graphic material.
> 10. Use of semi-conductors and miniaturization of electronic equipment.
>
> C. Changes in materials and direct inter-materials competition.
> 1. Improvement and further adoption of light-weight alloys of aluminum, magnesium, titanium, and beryllium.

2. Extension of the use of high-strength, light-weight steel.
3. Improvement and further adoption of high-temperature alloys and cermets.
4. Increased use of plastics and synthetics.
5. Increased use of plywood, hardboard, pasticle board, laminated wood, and fiberboard.
6. Possible development of antiknock compounds to displace tetraethyl lead and bromine.
7. Development of "exotic" fuels for rocket propulsion.
8. Increased use of waste materials and low-grade resources, thereby extending the supply.

. . . . . .

New technology ordinarily is not adapted unless its use is economic or it is attractive from the standpoint of serviceability or convenience. Consequently, a shift to a new material is seldom, if ever, rapid, unless the advantage is unmistakable. . . .

. . . . . .

No area in the world consumes industrial raw materials in quantities approaching those of North America. The volume is so great that the area can no longer be classified as a surplus materials area, in most respects. A growth of materials consumption at a rate slightly in excess of 4% a year, as projected in this study, will mean a doubling of the already huge requirements in less than eighteen years. Materials having a proved availability will have an advantage, and are likely to be the mainstay of industrial growth in the years to come.[1]

Although the basic assumptions of the study conducted by the Canadian-American Committee have proven valid till now, the War in Vietnam has had an influence particularly in the area of growth rates. The ratio of industrial crude

---

[1]Wilbert G. Fritz, The Future of Industrial Raw Materials in North America, (Canada: National Planning Association and Private Planning Association of Canada, 1960), pp. 59-61.

materials consumption to gross national product has only slightly declined over the thirty year period from 1926. See Table 3. The significance is that although the volume of materials used will continue to rise, there is only a very slight declining relationship of industrial raw material to the over-all growth of the economy.

Of particular importance in developing cost comparisons among regions is not to limit the comparisons to current supply sources. The prospective regions should be investigated for new supply sources that may provide a more favorable cost advantage. The economies of nearness to the raw material source are evident since freight rates generally increase with stages of fabrication. When the price policy of the raw material supplier is f.o.b. mill, another attraction is added to the raw material source.

The political decision to continue to reduce tariffs and import quotas can have a major effect upon the location decision in those industries which are raw material oriented. Particularly in those industries where deficiencies may appear in suitable raw materials, such as bauxite, lead, and tin, within the expected investment life of the new plant, investigation and consideration of foreign sources is only rational.[1]

The use of new material developing through technology

---

[1]Ibid., pp. 6, 7, 41, 42.

TABLE 3

RATIO OF INDUSTRIAL CRUDE MATERIALS CONSUMPTION TO GROSS NATIONAL PRODUCT IN THE UNITED STATES (IN PER CENT OF GROSS NATIONAL PRODUCT)

	1926-28	1947-49	1955-57	1980 Projection
Total industrial materials, except sawlogs & fuelwood	4.79	4.60	4.58	4.47
Mineral fuels	3.19	3.14	3.01	2.91
Non-fuel minerals	1.29	1.20	1.32	1.30
Forest products, except sawlogs & fuelwood	0.31	0.26	0.25	0.26

Data based on dollar figures adjusted for changing prices.

Source: Table 3, page 17, The Future of Industrial Raw Materials in North America, by Wilbert G. Fritz, 1960.

should be considered in the planning of a new branch plant. The regional location of new materials and new supply sources may differ from the more conventionally used raw material. Opportune investment in new and growth materials may have a strategic effect by capturing a larger market share due to early entry into a new industry or early introduction of products with superior characteristics.

Processing Costs

The most important processing costs to consider in regional analysis are rents and labor, as they constitute the major cost variables in the comparison of regions. Geographical differences result primarily because of the forces of immobility. Hoover indicated that factors of production that were fully mobile would seek equilibrum.[1] While some factors of production are fully mobile, such as capital, others, such as plant investment and labor, are immobile in the short run.

Differentials in rents among regions reflect the immobility of the characteristics of the land and "partly because there is such wide variation in the natural endowments of sites."[2] The question to be asked and answered in each case is, do the advantages inherent in the location offset the additional cost?

---

[1]Edgar M. Hoover, The Location of Economic Activity, (New York: McGraw Hill Book Co., Inc., 1948), p. 69.

[2]Ibid., p. 70.

The differences in labor cost among regions depend to some degree on labor immobility. Labor differences are expressed in wage rates, productivity rates, and real labor wage terms. Some of these differences are conveniently measured by the Census Bureau. Tables 4 and 5 show that wide differentials do exist in labor force and wage rates among regions, among states within a region, and even between adjacent cities. For example, Table 4 illustrates that the wages in the West are approximately 40% higher than in the South, that the wages in Alaska are more than double the wages in Arkansas, and that a 21% variance exists in the two nearby cities of Sacramento and Fresno, California. Table 5 amply illustrates that the greatest percentage increases in labor force will take place in the West and the South from now through 1980.

In an analyses of economic changes during the time from 1880 to 1950, Kuznets, Miller, and Easterlin discovered that in the manufacturing industry:

(1) The largest gains in proportion to labor force has been in the South, whereas the largest decline has been the dominant position of the Northeast.

(2) While the manufacturing labor force in the West grew only in proportion to the growth of the labor force of the nation, the North Central states have not only held their second-ranking position but also have risen to a

TABLE 4

AVERAGE HOURLY EARNINGS
BY REGION - 1964
(IN DOLLARS)

	May 1958	Mar. 1964	Supplemental Compensation Per Hour 1962
United States	1.97	2.30	.534
North East	1.94	2.29	.538
North Central	2.13	2.47	.592
South	1.63	1.90	.419
West	2.26	2.67	.588

AVERAGE HOURLY EARNINGS
HIGH & LOW STATES - 1967
(IN DOLLARS)

5 Highest States		5 Lowest States	
Alaska	4.23	Arkansas	2.02
Nevada	3.59	Mississippi	2.03
Michigan	3.47	North Carolina	2.03
Washington	3.37	South Carolina	2.07
Rhode Island	3.29	Georgia	2.21

AVERAGE HOURLY EARNINGS
SELECTED STATES & CITIES - 1965
(PRODUCTION WORKER IN MANUFACTURING INDUSTRY)
(IN DOLLARS)

New York	2.68
Buffalo, New York	3.01
North Carolina	1.82
Charlotte, North Carolina	1.91
California	3.05
Sacramento, California	3.29
Fresno, California	2.65

Sources: Statistical Abstract of the United States, 1968, 89th Annual Edition, U. S. Department of Commerce, Bureau of Census (Washington, D. C.: Government Printing Office, 1968), pp. 231, 232.

Economic Almanac, 1967-1968, Business Fact Book, National Industrial Conference Board, (New York: The Macmillan Company, 1967), p. 58.

TABLE 5

LABOR FORCE BY REGION
1960 & PROJECTED TO 1970 & 1980*

Region	Actual Manuf. Industries 1960	Actual All Industries 1960	Projection of All Industries 1970	Projection of All Industries 1980	Percentage of Change 1960 1970	Percentage of Change 1970 1980
United States	17.5	69.8	85.2	100.6	22.0	18.1
North East						
New England	1.4	4.3	5.0	5.7	16.5	14.3
Middle Atlantic	4.2	13.9	16.1	17.9	15.6	11.7
North Central						
East North Central	4.6	14.1	16.6	19.5	17.7	17.8
West North Central	1.0	5.9	6.7	7.7	14.4	14.8
South						
South Atlantic	2.1	9.9	12.6	15.1	27.2	19.9
East South Central	.9	4.2	5.1	6.0	22.2	16.9
West South Central	.9	6.1	7.7	9.2	24.6	20.1
West						
Mountain	.3	2.5	3.5	4.5	39.5	27.0
Pacific	1.8	8.6	11.5	14.4	34.3	25.3

New England: Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut
Middle Atlantic: New York, New Jersey, Pennsylvania
East North Central: Ohio, Indiana, Illinois, Michigan, Wisconsin
West North Central: Nebraska, Minnesota, Iowa, Missouri, North Dakota, South Dakota
South Atlantic: Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida
East South Central: Kentucky, Tennessee, Alabama, Mississippi
West South Central: Arkansas, Louisiana, Oklahoma, Texas
Mountain: Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada
Pacific: Washington, Oregon, California, Alaska, Hawaii

Source: Economic Almanac, 1967-1968 Business Fact Book, National Industrial Conference Board, (New York: The Macmillan Company, 1967), pp. 28, 29, 38.
*IN MILLIONS OF PERSONS

position where they can challenge the Northeast states for the top-ranking position.[1]

However, since 1950 the changes have dramatically shifted to spectacular growth in the West and South at the expense of the Northeast and North Central states. See Table 5.

> . . . knowledge of the general direction of movement is quite different from knowledge of the specific direction, and it seems likely that manufacturers, especially considering that manufacturing capital is not infinite, would adjust to the current known location rather than a future unknown one.[2]

To some industries, particularly those labor-oriented, labor costs are a major factor in location determination, whereas in other industries labor is less important but not unimportant. However, the rising costs of labor has had a definite impact on industry and has given rise to much of the investment in new plants and in labor-saving devices and equipment. In many cases the relocation of industry to the South is a manifestation of industry taking advantage of the cheaper labor of that region.

While labor unions have worked to standardize the wage scale for a particular job category throughout the country, wide disparity still exists. Because of this disparity in wages, labor differentials are most closely

---

[1]Simon Kuznets, Ann Ratner Miller, and Richard A. Easterlin, Population Redistribution and Economic Growth, United States 1870-1950, Vol. II, (Philadelphia: The American Philosophical Society, 1960), pp. 51-63.

[2]Ibid., p. 114.

analyzed at the community level of decision. In the regional decision broad analyses of average hourly earnings, labor wage scales by job category, per capita income, labor force distributions and projected percentage changes, and work stoppages are conducted. Further, labor laws and labor turnover rates are examined in the light of the particular needs of the firm. However, a necessary first step in determining a branch plant location is to ascertain whether a sufficient and stable supply of labor exists and, of course, the probability of continued supply considering the firm's needs for growth and the other requirements within the area. The broad analysis mentioned earlier provides a general evaluation of this labor consideration and helps screen out those areas least acceptable from the regional viewpoint. It should be understood that the result is not precise for comparison purposes since the many variables are not controlled in the data gathering process. For example, climatic and other environmental conditions such as management practices and control measures have a definite bearing on workers output, yet these variables are not controllable in drawing up comparisons among regions.

Trends in Industrial Location

Four broad-gauged trends significant to industrial location are:

(1) A regional decentralization out of the Northeast to the South and West.
(2) A local decentralization out of the large central cities.

The other two trends are functional in nature. They result from a variety of socio-economic changes, which have caused shifts in the relative importance of the kinds of industry locating new plants. These shifts result from differential growth rates, which in turn reflect such changes as the rise in the level of personal incomes, the growth of the services sector, and the increasing role of research and technology. These trends are:

(3) The increasing market-orientation of industry.
(4) The growth of "intellect-oriented" industries.[1]

The regional decentralization toward the South and West is expected to continue. Couple the broadening industrial base with the migration of population, most notably to the West, accelerated economic expansion can be expected in areas heretofore lacking in an industrial base. There is a "marked convergence in the ratio of manufacturing employment to population among the different regions of the country toward some common national ratio."[2]

The second major trend impacts mainly on the areas immediately adjacent to existing industrial concentrations. They have enjoyed much of the growth along with its concomitant problems. The huge capital investments are quite immobile; therefore, the largest shift here will be notice-

---

[1]Management and Economics Research Incorporated, Industrial Location as a Factor in Regional Economic Development, Prepared for U. S. Department of Commerce, (Washington, D. C.: Government Printing Office, n.d.), p. 31.

[2]Benjamin Chinitz and Raymond Vernon, "Changing Forces in Industrial Location," Harvard Business Review, January-February 1960, p. 127.

able by lesser relative degree of expansion.

The third major trend resulted from a declining pull of raw materials along with the philosophy of greater consumer orientation and the growth of market-oriented industries.

The fourth major trend is a more recent development. The "intellect-oriented industry" product differs from what is commonly expected from a manufacturer; they may produce "hardware," "software," advice, or a service. They are the fastest growing segment of the economy. They include the research and development activities of both industry and government, much of the aerospace industry, and electronic and precision instruments industries. Interestingly, the resources for this type of industry differs markedly from manufacturers in general. The resources include large pools of professional people of different disciplines, specialized services and components, and high risk capital investment. These industries are attracted to the suburbs, near centers of higher learning.[1]

In summary, the firm should consider its internal situation, determine the crucial location factors, and make comparisons of regions in light of the requirements of the firm. The firm should view the demand factor through the

---

[1]Management and Economic Research Incorporated, Industrial Location as a Factor in Regional Economic Development, Prepared for U. S. Department of Commerce, (Washington, D. C.: Government Printing Office, n.d.), pp. 31-37.

window of marketing strategies, seeking to gain competitive advantage through profit maximization. The other pertinent location factors of transfer cost, material cost, and processing cost should be examined broadly in an attempt to locate the least cost region. The relative importance of each location factor varies from one industry to another, but on final analysis the importance of each is weighed by its contribution to the optimum region. Throughout the chapter the author stressed the interrelationships that exist between the demand factors, the cost factors, and other considerations important to the makeup of the firm. Lastly the firm must detect trends and project their impact into the future.

The process of converting location factors and considerations to quantitative and qualitative terms in order to screen out unsatisfactory regions and to provide management alternative regions that best fit the needs of the firm is the subject of the next chapter.

CHAPTER IV

DECISION ANALYSES

General

The average firm that grows to prominence by serving the national market moves through four stages of development: the single plant; single plant, single warehouse; single plant, multi-warehouse; and multi-plant, multi-warehouse. These stages of growth reflect the choices of:

(1) establishing a new plant away from the existing one;

(2) continuing output at the existing plant without increasing its capacity (by working the existing plant more intensively; e.g., overtime, shift working, etc.);

(3) continuing output at the existing plant and also increasing its capacity; and

(4) establishing warehouses.[1]

Since the interrelationship of production with procurement, transportation, and marketing are most important and most complex, the location decision must be viewed in the context of the company "system." The strategic and long-range aspects of the decision are then adapted to fit the dynamic external and internal conditions of the present and future. Figure 3 illustrates the relationships.

---

[1]A. J. Merrett & Allen Sykes, The Finance and Analysis of Capital Projects, (New York: John Wiley & Sons, 1963), p. 270.

Figure 3

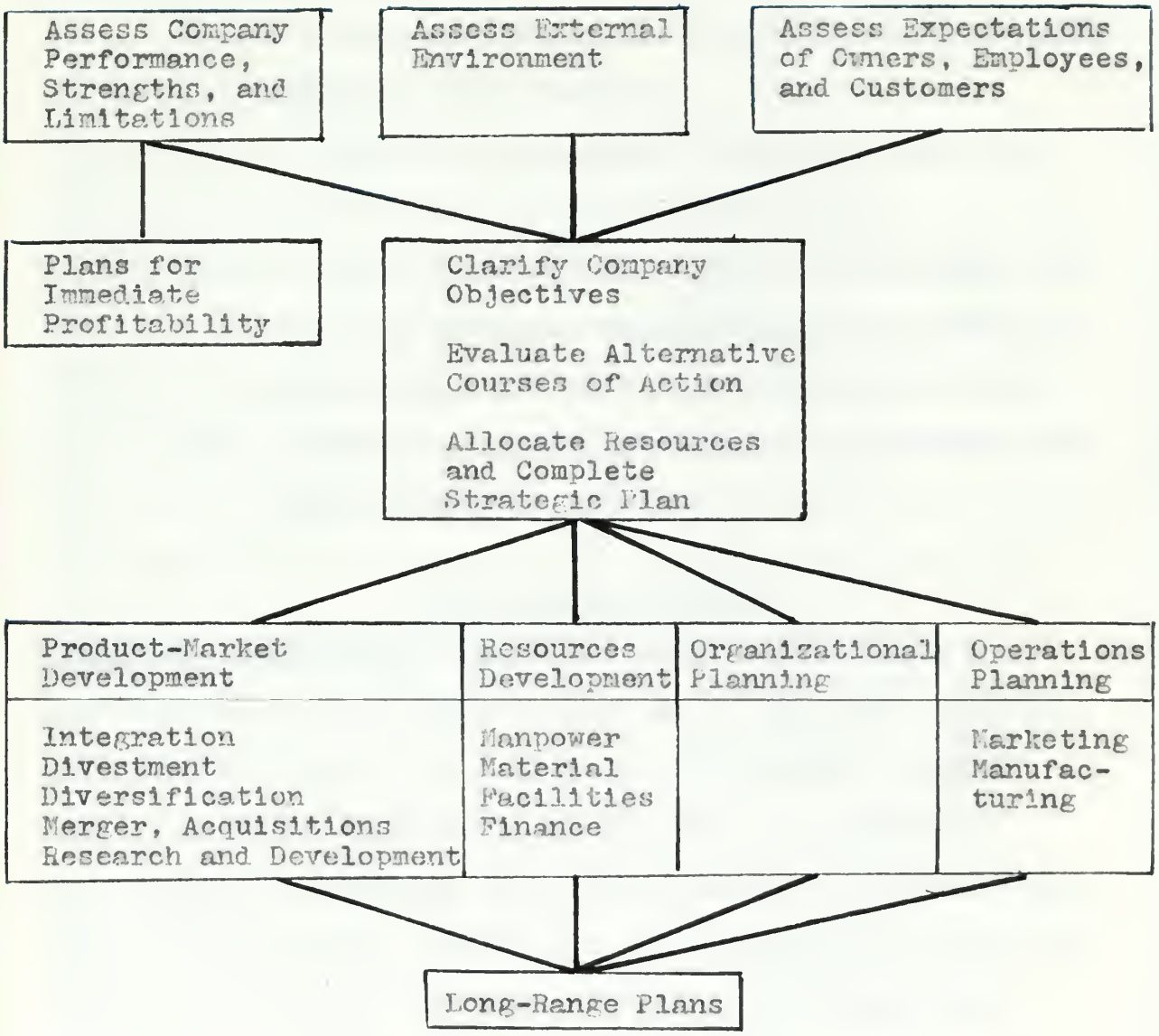

Figure 3--Strategic and Long-Range Planning. This figure points out the influences of internal and external conditions on facilities planning and its interrelationship in the company total system. Adapted from: "Business Planning--Where Financial Planning Fits," Patrick H. Irvin, Cost and Management, February 1968.

The proposal for a new branch plant should be systematically developed through a series of studies:

(1) a preliminary study--to determine if an adequate market appears likely.

(2) a technical requirements study--to state the requirements of the proposed plant.

(3) a technical feasibility study--to determine how well the technical requirements can be met and which region and what plant size is the best.

(4) an economic feasibility study--to determine the profitability of proposal.[1]

Quantitative Analysis

Technical Requirements Study--The study should state the requirements of the proposed plant as to quantity, quality, and specifications of each kind of raw material, supply, labor, transportation, fuel, power, etc. It should set forth detailed estimates of capital costs and the operating costs of procurement, production, and distribution based on stated assumptions. The study should reflect additional breakdowns of requirements and estimated costs based on alternate assumptions such as larger or smaller capacity. Thus, the study becomes a statement of what the region needs to have, what it is expected to cost, and what alternatives

---

[1]Murray D. Bryce, Industrial Development, (New York: McGraw-Hill Book Company, Inc., 1960), pp. 99-101.

should be considered. This study can be prepared without recourse to field analysis. Thoroughness in preparing the study provides the solid foundation for further investigation.[1]

Technical Feasibility Study--This study determines the availability, cost, quality, and accessibility of all the goods and services needed, by region, by assumed plant size. A comparative analysis should be made showing every requirement of the proposed plant studied individually for each region. Possibilities for substitution and trade-off are included in the analysis. Since limited markets and/or other constraints, such as limited labor supply, may reduce the plant size below optimum, the correct plant size for each region is an important economic consideration in determining the technical feasibility of the proposal. Further, since market size can vary in the future and production cost advantage greatly influences the firm's competitive position, consideration should be given to the timing of the expansion and to the trade-offs between loss in economies of scale in the smaller than optimum size plant to the loss in unutilized plant capacity in the optimum size plant. Therefore, the regional determination is closely interrelated with markets and plant size. While this study is taking place, the economic feasibility of the proposal can be studied also.

---

[1]Ibid., pp. 101-03.

Economic Feasibility Study--Clearly, at the regional level of decision a thorough analysis of markets for the product is essential, since in expansion the profit potential depends more directly on new volume than on savings in operating costs. Market analysis is not a difficult task when the customer is somewhat captive; i.e., when the product is an intermediate product and the customer is another division of a divisionalized corporation. However, this situation is usually the exception and thus market analysis is an important problem to contend with. Three important questions develop: How big is the market? What is its growth potential? How much of the market can be captured?

The size of the market can be approximated in several ways. For consumer products an examination of the current production of the product within the market area and production in adjacent market areas can be correlated to population. For industrial customers input requirements and operating output levels can be estimated. In addition, for the intermediate fabricator the market for the ultimate product can provide an indication of the market size for the intermediate product. From another viewpoint, demand in excess of supply is often accompanied by excessively high market prices; thus, the price provides a basis for estimation of real demand. The market size, however, can be expected to vary over time due to changes in production and

distribution costs, not only with the firm but also with the competitors.[1]

The growth potential of a market is a projection into the future using well established growth trends and/or justifiable facts, reasons, or assumptions. For example, the growth potential for a certain consumer good may be tied to growth trends in per capita income and expected growth or decline in population. An example of an assumption may be a projection of the increased demand due to price reductions and/or product substitution.[2] It should be understood that forecasting is the projection of future business conditions and company performance as related to the environment. Projection by extrapolation, ratio, and correlation methods, growth composition analysis, and migration estimation are a few of the techniques usable for this purpose.

The amount of market area able to be captured is fraught with uncertainty due to the unknowns in the behavior of competitors. Walter Isard and Michael Dacey conducted an interesting experiment in the projection of individual behavior in regional analysis. When a competitor was introduced into a location decision the projection of an individuals behavior was possible in only a few cases. They concluded that an individuals attitude is a basic variable and little knowledge exists on how an individual transforms an

---

[1]*Ibid.*, pp. 111-13.

[2]*Ibid.*, p. 114.

outcome into a utility or other value of internal significance.[1] However, an approximation is possible.

> The first thing to do is assemble a list of all plants in the industry which might be competitive with as much information as possible concerning capacity, production, age of plant, type of process, and equipment, profitability expansion plans, management, marketing organization and effectiveness, brand acceptance, financial strength, and any other factors which might affect their ability to compete with the project under analysis. If some of the possibly competitive plants are located in other places, it is often helpful to plot the market areas on a map, using concentric rings (joining points where delivered product costs are equal) to show their decreasing competitive strength. (The farther the market areas are from the factory, the greater the cost of transporting the product.)[2]

From this data reasonable predictions can be drawn as to courses of action that are available to competitors. The probabilities of competitor action can be estimated through the technique of game theory, and an expected monetary value can be placed on revenues. In the derivation of costs for comparison of regions it is more important that the right cost factors, even if roughly estimated, be considered than precisely measuring irrelevant cost factors. Further, the cost should represent only those out-of-pocket costs or opportunity costs that are affected by the proposal. Thus the computations are made under the varying assumptions of

---

[1]Walter Isard and Michael Dacy, "On the Projection of Individual Behavior in Regional Analysis: I & II," Journal of Regional Science, Volume 4, 1962, pp. 51-83.

[2]Murray D. Bryce, Industrial Development, (New York: McGraw-Hill Book Company, Inc., 1960), pp. 114-115.

market size and share, plant size, operating level, transport mode raw material source, etc.

Computational Techniques--The information developed for determining the regional location of the new branch plant should be directed toward revealing differences between the alternative regions. Two basic approaches to computation are available, the aggregate revenue and cost approach and the crucial factor approach.

The aggregate or total revenue and cost approach uses the total system concept. It views the physical flow of the product from the raw material to the ultimate user and considers all revenues and costs from beginning to end. Although conceptually looking at the location decision in this way is superior to the crucial factor approach, there are a great many disadvantages. The main disadvantages are time delay in accumulating and evaluating the cost and revenue data and the expense involved. However, a virtue of this approach is that it provides the data for the community and site level decisions. The tools usable in this approach are operations research, linear programming, simulation, electronic data processing systems, and, to a limited degree, manual input-output analysis. The total system analysis is useful in the periodic analysis of the operations of the firm but is not a realistic approach to the regional location decision problem.

The crucial factor approach fragments the problem. It simplifies the computation requirements by determining the appropriate items to cost then determines those items that have a significant effect on the result. Thus this approach is oriented to simplification through identification of the crucial factors that bear on the decision. The main disadvantage is that the result is not as precise as the total revenue and cost approach. The main advantages are shortened time delays in accumulating and evaluating the cost and revenue data, decreased expense, and less complicated manual cost analysis for simple location problems. The sophisticated management tools mentioned earlier are usable in this approach as well.

The techniques usable in developing cost/revenue data for analysis will vary with the problem. Some of the more important are:

(1) Time Series analysis of past and existing revenue and cost information for projecting future data.

(2) Sampling to provide inferences about population characteristics with specified degrees of reliability.

(3) Correlation to estimate an unknown variable when the value of another variable is known.

(4) Index number to provide a measurement of change relative to a base.

(5) Log normal graphs to plot relationships particularly between item-demand rates of products.

(6) Comparative analysis to determine the net difference between alternative choices.

(7) Marginal analysis of consumption to determine the relationship between income and consumption.

(8) Game or payoff matrix to analyze a competitive situation involving conflicting interest between two or more persons.

(9) Linear programming to determine an allocation of limited resources in order to maximize some benefit and minimize some cost subject to specific constraints.

For quantitative analysis on the regional level, the crucial factor approach is not only the most practical but the most timely and economical. Using this approach comparative analysis is the basic technique for examination of the pertinent and measurable costs and revenues.

Walter Isard, a proponent of the comparative cost study approach theorized that:

> The theoretical scheme which formalizes the methodology of the comparative cost study is substitution analysis. . . Essentially this

> analysis considers alternative locations in terms of substitution between transport inputs, between diverse outlays, between diverse revenues, between outlays and revenues, and between combinations of these substitutions. The best location, in an economic sense, is one where no move elsewhere could result in further favorable substitution; that is, in reduction in total production and delivery cost. Each of the regional cost differentials of a comparative study measures the effect of either a single or a combined substitution involved in the decision to locate in one region rather than another.[1]

In essence, a ten point approach should be included in the comparative analysis:

(1) Determine and define the alternative regions.

(2) Determine whose costs will be affected other than the firm.

(3) Determine what items are appropriate to cost.

(4) Determine what are the crucial items, those that have a significant influence on the decision.

(5) Develop the necessary data using appropriate computational techniques.

(6) Use future costs.

(7) Determine competitive, technological, and trend factors appropriate to the decision.

(8) Determine the assumptions which can be varied to increase profitability.

(9) Determine the risk for each alternative region

---

[1]Walter Isard, Methods of Regional Analysis, (Cambridge: MIT Press, 1960), p. 240.

under each stated assumption.

(10) Determine the profitability.

Once the special comparative advantage of one region over another as to operating costs is determined, analysis of the possible behavior of competitors can be considered in determining the size of the market and how much of it can be captured.

Studies provide then the specifications the new location is to meet, the critical cost factors, a detailed study of market areas and competitive forces, and an evaluation of regions. They identify the geographical regions that meet the broad location requirements and determine which of the alternate regions satisfies the location requirements at maximum profit. Therefore, at this point the firm has screened out the unsuitable regions using those factors that are quantifiable.

Of critical importance to the firm but outside the scope of this paper is the determination of capital costs and the return on investment of the branch plant proposal. However, the point will be made that financial analysis of the project is essential to sound judgement not only by the decision-makers of the firm but also a wide range of other interested parties such as stock-holders, lenders, and creditors. It is important not just because location choice affects the rate of return on the initial investment nor because of the social impact on the region and community in

which the new branch plant is to be located. It also has an impact on future investments, as companies usually resist abandonment of "sunk" investment and attempt to take advantage of existing facilities and economies of larger scale production. In the longer range view the competitive position of a firm is at stake, since it is determined by many individual decisions over the years.

Non-Quantitative Analysis

Not all important location criteria can be as easily quantified as most of the cost and revenue factors. Although at the regional decision level for the new branch plant the intangibles/non-quantitative factors are usually only a few in number, their influence is often felt. An example of such a factor at the regional level of decision might be the degree to which the regional location may affect communications and control from the parent office. The intangible factors must be assessed subjectively and weighted for evaluation. Since value judgements are involved, the essential aspect is that objectivity be employed in determining what these factors are, what is a rational basis for weighting their importance, and what should be the standard for rating the degree or strength of the factor. The reasoning for each criterion should suit the particular firm. An approach for evaluation could be:

(1) Draw up a list of the crucial intangibles.

(2) Weight each on a basis of importance on a scale of 1 - 10 with benchmarks of: 10 - extremely important, 6 - highly important, 3 - moderately important, 1 - little importance.

(3) Rate each intangible on a basis of its existence on a scale of 0 - 3 with benchmarks of: 3 - excellent, 2 - good, 1 - fair, 0 - poor.

(4) Multiply each weighted intangible times its rated score, add all scores within a region to determine the best region.

The scaling technique that has been developed for use in the fields of psychology and sociology is a useful tool for measuring the somewhat intangible aspects of attitudes. The Scalogram technique or Guttman scaling attempts to identify a single scale along which effectiveness of attitudes in a given situation can be attained. The technique transforms qualitative and non-comparable quantitative information into a numerical ranking (ordinal values), thereby ranking regions based upon the study.[1]

Similar to quantitative analyses, non-quantitative analyses would screen out those regions that are unsatisfactory by its standards and provide to management the alternative locations ranked according to their contribu-

---

[1]Walter Isard, Methods of Regional Analysis, (Cambridge, Mass.: MIT Press, 1960), pp. 281-89.

tion to the firm.

Although the additional benefits or costs cannot be measured directly, the cost of selecting a region that is other than the maximum profit location is measurable by the net difference in profitability between the one selected and the maximum profit location. Therefore, the cost of non-quantifiable considerations can be viewed in the light of the opportunity costs thus developed. Now that the opportunity cost has been deduced, do the benefits justify the cost? Ultimately the decision maker must make this value judgement.

Thus the broad quantitative and non-quantitative analyses provide management with alternative regional locations with their relative advantages or disadvantages reduced to dollar terms or some other standard. The objective of analyses is not just to determine acceptable regional locations but to rank them in order of desirability.

The words of Murray D. Bryce summarize well the meaning of this chapter:

> Preparing, analyzing, and appraising industrial projects cannot be systematized into a process of calculations, although various standards and measures should be used more widely as aids. The important decisions in regard to projects are, in the end, value judgements based on the investor's or appraiser's experience, but they should always be made on the basis of thorough research and analysis.[1]

---

[1]Murray D. Bryce, Industrial Development, (New York: McGraw-Hill Book Company, Inc., 1960), p. x.

CHAPTER V

CONCLUSIONS

In the investigation and research for this thesis it became very clear that the location decision is one of the most important decisions a firm has to make. The complexity of the problem situation results from the interrelationship of location with most if not all the cost and revenue factors that touch a firm. The external forces of environment and competition broaden the scope of investigation and consideration.

The main contribution in the study of classical theories of location is the development of a frame of reference, a better understanding of the interrelationship of the many parts to the whole and an ability to recognize the crucial factors of location. Since location theory attempts to build on empirical study, it requires continual modification to explain the real world. One must, however, remember that location decisions are based not just on theory or historical experience but upon expectations derived from an analysis of the future. The major factors of consideration for the location decision at the regional level are markets, transfer costs, processing costs, materials, and trends. What the crucial factors are depends upon the

particular firm. It is evident that a need exists for a more workable theory relative to the interrelationship between location theory and production and trade theory. Further, the concept of rational behavior needs further elaboration and clarification when unknown actions or choices available to competitors are involved.

The changing structure of production processes, increasing mobility of labor, innovations in transportation modes and systems and greater consumer-orientation are resulting in a definite trend toward greater decentralization and regionalization of industry.

Generally, the pull of the market has the greatest effect in new plant expansion. The branch plant is a manifestation of industry's reaction to this pull.

For the regional decision the maximum profit theory holds the best logic for analysis. Although analyses must remain broad and more general than the community and site level of decision, computations and analysis can still be expressed in an explicit fashion with discrete rankings of relative advantage, at least within the evaluation system used. However, there is no correct or absolute way of amalgamating the quantifiable and non-quantifiable factors of consideration into an optimal solution. Values can be placed on one or the other in order to give the factor considerations a common base, but this system is less than perfect.

No universally workable models were located during the conduct of this study. It would appear that the only solution available, at least at present, is to devise a singular model to fit each situation. For example, in the computer-program approach to determine the optimum location, Edgar M. Hoover concluded after experimenting with seven models that:

> . . .the present programs are primarily applicable to transport-oriented manufacturing industries and their useful applications are in the field of planning and impact studies rather than in giving any guidance to the location decisions of an individual firm.[1]

An understanding of the location factors and a deliberate well-organized approach provide the following additional outstanding benefits:

(1) More useful information when the studies are well done.

(2) Reduces hesitancy, false moves, and unnecessary changes in action or course.

(3) Provides necessary information for banks, insurance companies, and other sources of capital.

(4) Considers the location decision within the framework of the total company system which includes the distribution system, logistic system, personnel system, and information system.

---

[1]Edgar M. Hoover, "Some Programmed Models of Industry Location," Land Economics, Vol. 43, 1967, p. 303.

(5) Provides the basis for a re-evaluation of such matters as plant size and utilization, new material sources, new markets, new products, product mix, etc.

(6) Provides a framework for value judgements relative to the firms decision process.

(7) And, of course, better quality decisions.

BIBLIOGRAPHY

Public Documents

U. S. Congress, Economic Indicators, 91st Cong., 1st Sess., January, 1969.

U. S. Department of Commerce, Industrial Location as a Factor in Regional Economic Development, by Management and Economics Research Incorporated, Washington, D. C.: Government Printing Office, n.d.

U. S. Department of Commerce, Statistical Abstract of the United States, 1967, 88th Annual Edition. Washington, D. C.: Government Printing Office, 1967.

U. S. Department of Commerce, Statistical Abstract of the United States, 1968, 89th Annual Edition. Washington, D. C.: Government Printing Office, 1968.

Books

Bartlett, Hale C. Readings in Physical Distribution. Danville, Illinois: The Interstate Printers and Publishers, Inc., 1966.

Bryce, Murray D. Industrial Development, New York: McGraw-Hill Book Co., Inc., 1960.

Buell, Victor P. "The Major Challenge to Marketing." Emerging Trends in Marketing. New York: National Industrial Conference Board, 1965.

Edge, C. G. A Practical Manual on the Appraisal of Capital Expenditure, Ontario, Canada: The Society of Industrial and Cost Accountants of Canada, 1966.

Estall, R. C., and Buchanan, R. Industrial Activity and Economic Geography. London: Hutchinson University Library, 1961.

Fritz, Wilbert G. The Future of Industrial Raw Materials in North America. Canada: National Planning Association and Private Planning Association of Canada, 1960.

Greenhut, Melvin. Plant Location in Theory and Practice. Chapel Hill: The University of North Carolina Press, 1956.

Heskett, J. L.; Ivie, Robert N.; and Glaskowsky, Nicholas A., Jr. Business Logistics. New York: The Ronald Press Co., 1964.

Hoover, Edgar M. Location of Economic Activity. New York: McGraw-Hill Book Co., Inc., 1948.

Isard, Walter. Location and Space Economy. New York: Wiley and Technology Press of M.I.T., 1956.

Isard, Walter. Methods of Regional Analysis. Cambridge: M.I.T. Press, 1960.

Kuznets, Simon; Miller, Ann Ratner; and Easterlin, Richard A. Population Redistribution and Economic Growth, United States 1870-1950. Vol. II. Philadelphia: The American Philosophical Society, 1960.

Loesch, August. The Economics of Location. Translated by Wolfgang F. Stopler. New Haven: Yale University Press, 1954.

Magee, John F. Physical-Distribution Systems, New York: McGraw-Hill Book Co., 1967.

Merrett, A. J., and Sykes, Allen. The Finance and Analysis of Capital Projects. New York: John Wiley & Sons, 1963.

National Industrial Conference Board. Economic Almanac, 1967-1968, Business Fact Book. New York: The MacMillan Co., 1967.

Roepke, Howard G. Readings in Economic Geography. New York: John Wiley & Sons, Inc., 1967.

Smykay, Edward W.; Bowersox, Donald J.; Mossman, Frank H. Physical Distribution Management. New York: The MacMillan Co., 1961.

Stamp, L. Dudley. A Regional Geography, Part I, The Americas. 9th Edition, London: Longmans, 1959.

Von Thünen, Johann Heinrich. Von Thünen's Isolated State. Translated by Carla M. Wartenberg. New York: Pergamon Press, 1966.

Weber, Alfred. Alfred Weber's Theory of the Location of Industries. Translated by Carl J. Friedrich. Chicago: The University of Chicago Press, 1929.

Whitman, Edmund S., and Schmidt, W. James. Plant Relocation. New York: American Management Association, 1966.

Yaseen, Leonard C. Plant Location. New York: American Research Council, 1960.

Articles

Atkins, Robert J., and Shriver, Richard H. "New Approach to Facilities Location," Harvard Business Review, May-June 1968, pp. 70-79.

Barloon, Marion J. "The Interrelationship of the Changing Structure of American Transportation, and Changes in Industrial Location," Land Economics, Vol. XLI, No. 2, May, 1965 , pp. 169-79.

Bawden, D. Lee. "An Evaluation of Alternative Spatial Models," Journal of Farm Economics, Vol. 46, December 1964, pp. 1372-79.

Carrier, Ronald E. and Schriver, William R. "Location Theory: An Empirical Model and Selected Findings," Land Economics, Vol. XLIV, No. 4, November 1968, pp. 450-60.

Chinitz, Benjamin, and Vernon, Raymond. "Changing Forces in Industrial Location," Harvard Business Review, Vol. 38, No. 1, January-February, 1960 , pp. 126-36.

Crookell, Harold. "The Gulf Between Economic Theory and Marketing Practice," Cost and Management, June 1968, pp. 18-21.

Greenhut, M. L. "When is the Demand Factor of Location Important," Land Economics, Vol. 40, 1964, pp. 175-84.

Gruen, Nina J., and Gruen, Claude, "Behavioral Approach to Determining Optimum Location For the Retail Firm," Land Economics, Vol. 43, 1967, pp. 320-27.

Harris, Chauncy D. "The Market as a Factor in the Localization of Industry in the United States," Annals of the Association of American Geographers. December 1954, pp. 315-48.

Hayes, Charles R. and Schul, Norman W. "Why Do Manufacturers Locate in the Southern Piedmont?", Land Economics, Vol. XLIV, No. 1, February 1968, pp. 117-21.

Hetrick, James C. "Mathematical Models in Capital Budgeting," Harvard Business Review, January-February 1961, pp. 49-64.

Hoover, Edgar M. "Some Programmed Models of Industry Location," Land Economics, Vol. 43, 1967, pp. 303-11.

Irwin, Patrick H. "Business Planning--Where Financial Planning Fits," Cost and Management, February 1968, pp. 7-8.

Isard, Walter and Dacy, Michael, "On the Projection of Individual Behavior in Regional Analysis: I and II," Journal of Regional Science, Volume 4, 1962, pp. 1-34, 51-83.

"New Realities of Plant Investment," Dun's Review, Part II, March 1963, pp. 92-94.

Norton, Frank E. "Administrative Organization in Capital Budgeting," Journal of Business, Vol. XXVIII, No. 3, July 1955, pp. 291-295.

Pearson, Robert W. "Productivity, Costs, Wages, and Profits in New Vs. Old Plants," Industrial Development and Manufacturers Record, January-February, 1968, pp. 28-33.

"Relocation: The Right Way to Pick a New Location," Business Management, April 1968, pp. 41-47.

Teitz, Michael B. "Locational Strategies for Competitive Systems," Journal of Regional Science, Vol. 8, No. 2, 1968, pp. 135-48.

Vergin, Roger C. and Rogers, Jack D. "An Algorithm and Computational Procedure for Locating Economic Facilities," Management Science, Vol. 13, No. 6, February 1967, pp. B240-54.

Other Sources

Casey, Irving, Industrial-Location Theory in the Era of Super-Cargo Aircraft, Falls Church, Virginia: Analytic Services Inc., 1967.

Charles River Associates Incorporated, A State of the Art Report, The Role of Transportation in Regional Economic Development, prepared for U. S. Department of Commerce, Cambridge, Mass., n.d.

Cleland, David Ira, The Origin and Development of a Philosophy of Long-Range Planning in American Business, Technical Report 66-11, Air Force Institute of Technology, Air University, U. S. Air Force, 1962.

thesB2033
The capital expenditure decision :
3 2768 001 91250 4
DUDLEY KNOX LIBRARY